Can the Buffering Effects of Sodium Bicarbonate Reduce Muscle Damage as Measured by Creatine Kinase?

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Introduction

- Sodium bicarbonate (SB) , a buffering agent , can improve performance with intense exercise and decrease perceived exertion
- Bicarb in the blood draws H^+ out of the cell maintaining a more favorable pH within the cell; ATP producing enzymes are less adversely affected during high-intensity exercise
- Creatine kinase (CK), an indicator of muscle damage, increases with intense exercise due to decreased intracellular ATP (1)
- Maintaining ATP levels in the cell by using SB may reduce muscle damage and CK levels

Purpose

To investigate whether the buffering effects of sodium bicarbonate can minimize muscle damage

Methods

- Institutional Review Board approval was received for this research, and all participants signed an informed consent
- In a double-blind crossover design, 20 college-aged subjects (12 male, 8 female) consumed 90 minutes before exercise either:
  - 500mL of Kool-Aid with 0.3g SB/kg body weight or
  - 500mL of Kool-Aid (half water, half club soda) with 0.045g NaCl/kg body weight
- Exercise: completing 30 laps of running up and down stairs as quickly as possible followed by push-ups to fatigue
- Blood lactate, heart rate, rate of perceived exertion (RPE), and gastrointestinal (GI) distress (0-10 scale) were measured pre and post exercise; CK was measured pre and 48 hours post exercise. Data was analyzed using a repeated measures ANOVA and paired *t*-tests
- CK was evaluated using an EnzyChrom (ECPK-100) assay

Acknowledgments

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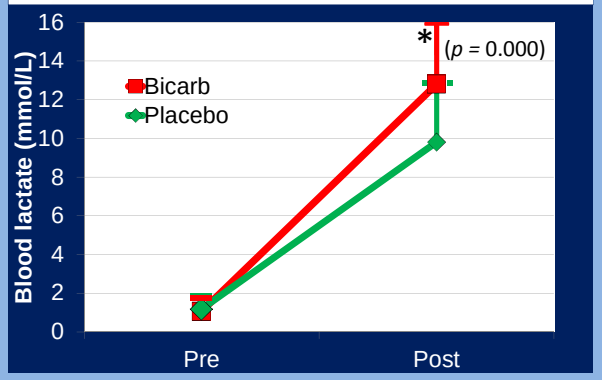
Reference: (1) Baird, M.F., Graham, S.M., Baker, J.S. & Bickerstaff, G.F. (2011). Creatine-kinase and exercise-related muscle damage implications for muscle performance and recovery. *Journal of Nutrition and Metabolism*, 2012, 1-13.

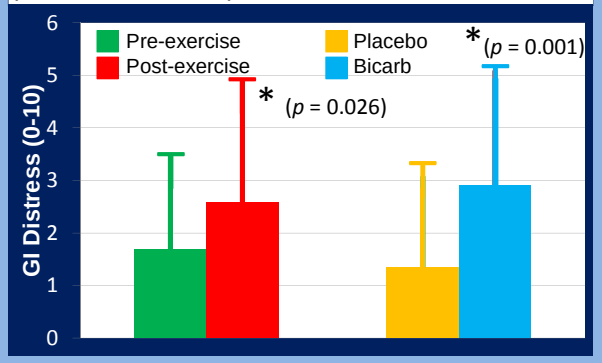
Blood lactate (mmol/L) pre and post exercise



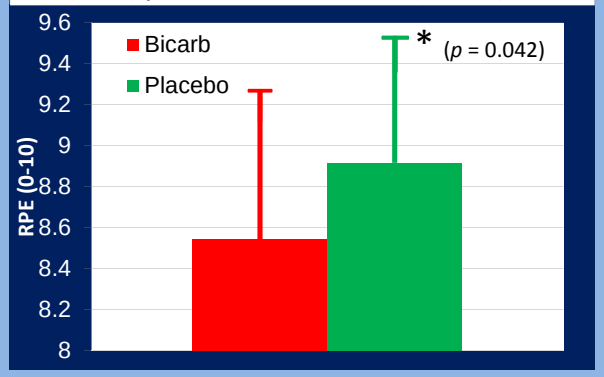
	Pre Exercise Placebo	Pre Exercise Bicarb	Post Exercise Placebo	Post Exercise Bicarb
CK (U/L)	145 ± 70	162 ± 90	160 ± 87	163 ± 94
Time (sec)			10.2 ± 0.7	10.1 ± 0.8

23g Sodium bicarbonate (for a 77kg person)

Average gastrointestinal distress (0-10) pre to post exercise and placebo vs. bicarb



RPE (0-10) post exercise in males (*N* = 12)



Conclusions

- Lactate levels were higher (in males and females) and RPE was lower (in males) with SB despite similar HRs (working at 90% max HR) in both genders
- GI distress was higher pre exercise in the SB trial, but increased less post exercise; 60% reported GI distress of 3 or lower (0-10 scale) immediately before and after exercise in the SB trial
- Treatments were successfully blinded pre exercise, but 80% correctly predicted their treatments after experiencing GI symptoms
- Time was ave 7.5 sec faster with SB, which was not statistically significant, but might be important in a race
- CK did not increase significantly pre to post; the exercise protocol used failed to induce significant muscle damage
- A more vigorous exercise protocol must be used to determine the possible protective effects of SB against muscle damage